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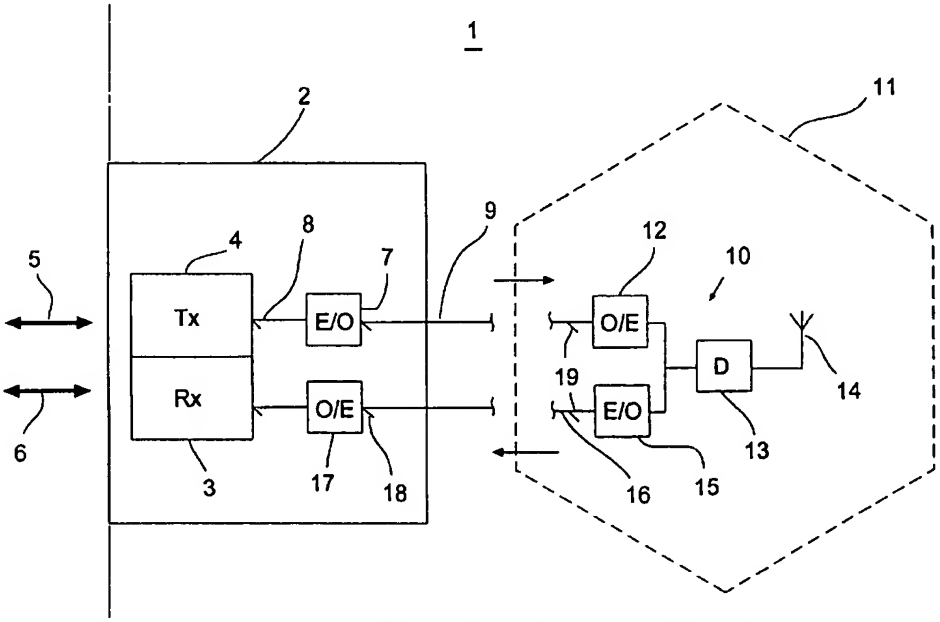
(54) Title: MOBILE BASE STATION SYSTEM WHERE THE CENTRAL UNIT AND THE ANTENNA UNITS ARE SEPARATED FROM EACH OTHER



(57) Abstract: The present invention relates to a mobile base station system 81) including a central unit (2) and at least one antenna unit (10). The system is characterized in that the central unit (2) includes means (3, 4) to function/operate according to two different access standards, in that at least a first one of said antenna units (10) is detached from the central unit (2) and located geographically separated from this, and in connection devices (9, 16) which connect the central unit and said first antenna unit.

WO 02/30141 A1

Mobile base station system where the central unit and the antenna units are seperated from each other

TECHNICAL FIELD

The invention relates to a mobile base station system according to the introduction to the patent claim 1.

BACKGROUND OF THE INVENTION

Mobile cellular telephone systems according to different standards have, as regards capacity, developed very rapidly in recent years. The ever increasing demands of the users on performance of the systems then has required advanced cell planning. The introduction of geographically small cells (micro cells), which contain base station systems with comparatively small output power (micro bases), has provided increased possibilities for such cell planning. Micro cells are used at places with high traffic density, such as airports.

The building/extension of a mobile system requires big financial resources, so cell planning includes advanced optimization problems for the operator of the system. The building/extensions of mobile systems which have been made lately mainly relates to the mobile systems of the so called second generation, preferably according to the standards GSM, D-AMPS and PDC.

When the mobile systems of the third generation now are introduced, this implies heavy operator expenses because a complete infrastructure, parallel with the infrastructure of the systems of the second generation has to be built. The directing of the systems of the third generation towards broadband packet data services in addition puts forward especially high demands on high capacity. Further, there are also systems for wireless data communication networks being built, so called WLAN (Wireless Local Area Network), which require further infrastructure at high costs.

Generally, the introduction of new systems implies heavy expenses, because existing infrastructure has to be replaced and because a multitude of base stations with belonging antenna systems have to be arranged.

SUMMARY OF THE INVENTION

An aim of the present invention is to wholly or partially eliminate above mentioned problems.

This aim is achieved by a mobile base station system according to patent claim 1.

More exactly, the invention relates to a mobile base station system including a central unit and at least one antenna unit. According to the invention, the central unit includes means to function/operate according to at least two different optional access standards, in that at least a first one of said antenna units is detached from the central unit and located geographically separated from this. Further, there are connection devices which connect the central unit and the first antenna unit. In such a system, a system of the second generation, for instance according to GSM/GPRS-standard, can function/operate beside a later mobile system, for instance according to a UMTS-standard, or a WLAN-standard, (for instance IEEE 802.11). Further, the above mentioned central unit can be utilized together with a number of different antenna units located separated from each other. This allows that a plurality of small and large cells are established at a distance from the central unit, which provides possibilities for cost efficient cell planning.

The connection device preferably includes at least a pair of optical fibers, such as single mode fibers or multimode fibers for transmission/transfer of signals. This allows broadband information transmission between central unit and antenna unit.

According to one preferred embodiment, the connection device further includes a cable for power supply. If such a

cable exists, no specific power supply need to be arranged at the place where the antenna unit is located.

The central unit preferably includes means to function/operate according to at least two of the following access standards: UMTS, GSM/GPRS, GSM/EDGE, HIPERLAN 2 and IEEE 802.11. This makes cost efficient upgrading of existing systems to newer standards possible.

According to one preferred embodiment, the central unit utilizes, at execution of information transmission according to the at least two access standards, one for these common interface towards a mobile network (PLMN), to which the base station system is connected. Such a system makes the utilization of a common network for two different standards possible.

The central unit preferably includes a software based radio transmitter/radio transceiver (software radio). Such a system allows rearrangement and reconfiguration of the central unit without substantial changes in the hardware of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a system according to the present invention.

Figure 2 shows an example of how the traffic in a group of cells, which is served by a common central unit according to the invention, gradually can be adapted to new future standards.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 shows a base station system 1 according to the present invention. The system 1 includes a central unit 2 which has at least one radio unit with a receiver part 3 and a transmitter part 4. According to the invention, the radio part is equipped to operate according to at least two different access standards. With such a radio part, the base station 1 can be called a multimode base station. The

base station then is said to operate in a plurality of modes, when it operates at the same time and optionally according to different access standards. It is advisable to utilize common interface for signaling 5 and data transmission 6 for the different modes. In that way a common basic network can be used for the different standards. The system then can be said to have a transparent radio architecture. Channel allocation and allocation according to standard can be made dynamically.

The radio part 3, 4 can be realized as a hardware solution with different groups of integrated circuits for different standards. Preferably, however, a software based radio part is used where the major part of the signal processing from base band signal to radio frequency signal is done as data processing in a processor.

To the transmitter part 4 of the radio unit, a transmitting E/O (electric to optical)-converter 7 is connected. Possibly, a plurality of such converters can be fed by the transmitter part 4, making it possible to talk about a star architecture. In such cases there is another/one more connection 8 from the transmitter part 4. The transmitting E/O-converter 7 modulates an electrical radio signal (downlink) from the transmitter part 4 on an analog optical signal which is transmitted over a first optical broadband fiber 9. A laser which generates the optical signal then can be modulated in different ways (directly or externally) to generate the wanted modulated optical signal. Possibly, an optical splitter can be located close to the transmitting E/O-converter 7 to allow that the modulated optical signal is transmitted in different directions in a star or bus architecture.

The first optical fiber 9 leads from the transmitting E/O-converter of the central unit to a detached antenna unit 10, which provides coverage within a cell 11 at a distance from the central unit 2. There the modulated signal is received by a receiving O/E (optical to

electric)-converter 12, which converts the optical signal to an electric radio signal. This signal is amplified and connected via a duplex filter 13 to an antenna 14 and is transmitted by this to a terminal (not shown), such as a mobile telephone. Also at the receiving O/E-converter 12, an optical splitter 19 can be located.

In a similar way signals from a terminal which are received by the antenna 14 (uplink) are processed/handled. These are passing through the duplex filter 13 to a transmitting E/O-converter 15. The duplex filter 13 is intended to make possible that the same antenna can be utilized for transmission and reception. The transmitting E/O-converter 15 modulates the received electric radio signal on an optical signal from a laser and transmits this signal by means of a second optical fiber 16 to a receiving O/E-converter 17. This converts the received optical signal to an electric signal which is fed to the receiver part of the radio unit 3. Between the central unit 2 and the detached antenna unit 10 there also can be a power supply cable (not shown). This makes central power supply of the antenna unit possible. It can also be utilized for narrow band signaling and for instance for tuning the duplex filter 13 of the antenna unit. As is indicated in the figure, each transmitter part 4 and each receiver part 3 can be connected to a plurality of different E/O-converters respective O/E-converters. Also optical splitters 18, 19 can be located between the different O/E-converters and E/O-converters to make different star and bus architectures in the optical domain possible.

Figure 2a-2d shows an example of how a group of cells, which are served by a common central unit according to the invention, gradually can be adapted to new future standards. The central unit of the base station, which in the figures is denominated "B", is in this example connected with detached antenna units, which serve ten different cells of different sizes.

In Figure 2a the antenna units in all cells are capable of communicating according to the GSM/GPRS-standards. Cells with this ability are in the figures given the denomination "G". Further, the antenna units in certain cells are capable to communicate according a WLAN-standard, such as IEEE 802.11. These cells are in the Figures 2a-2d given the denomination "W".

In Figure 2b the antenna units of some cells have been given the ability to communicate according to a UMTS-standard and others according to a HIPERLAN-standard. These cells now have been given the denomination "U" respective "H". Because the central unit functions as a multimode base station, these changes can be made by smallest possible investments.

Figure 2c and 2d shows further development of the system. In Figure 2d the system has wholly changed to communication according HIPERLAN and UMTS. Communication according to GSM/GPRS and WLAN-standards is then no longer of current interest.

A system according to the invention functions in indoor systems as well as in outdoor systems. The central unit can be located anywhere where there is suitable place and power supply, without any specific considerations regarding radio transmission conditions. The central unit only requires little power.

Also the antenna units can operate with comparatively little power because it will be considerably cheap to add extra antenna units, so the number of antennae can be made large, which results in small cells and good frequency recovery.

The system further can essentially be upgraded over the mobile network to which it is connected. This results in a flexible system.

PATENT CLAIMS

1. Mobile base station system including a central unit (2) and at least one antenna unit (10), c h a r a c t e r i z e d in that the central unit (2) includes means to function/operate according to at least two different access standards, that at least a first one of said antenna units (10) is detached from the central unit (2) and located geographically separated from this, and that connection devices (9,16) connect the central unit (2) and said first antenna unit (10).

2. Mobile base station system as claimed in patent claim 1, at which the system includes a plurality of detached antenna units, which are located geographically separated from each other.

3. Mobile base station system as claimed in any of the previous patent claims, at which said connection devices include at least one optical fiber for signal transmission.

4. Mobile base station system as claimed in patent claim 3, at which said optical fiber is a single mode fiber.

5. Mobile base station system as claimed in patent claim 3, at which said optical fiber is a multimode fiber.

6. Mobile base station system as claimed in any of the patent claims 3-5, at which said connection devices further include a cable for power supply.

7. Mobile base station system as claimed in any of the previous patent claims, at which said central unit includes means to function/operate according to at least two of the following access standards: UMTS, GSM/GPRS, GSM/EDGE, HIPERLAN 2 and IEEE 802.11.

8. Mobile base station system as claimed in any of the previous patent claims, at which the central unit at execution of transmission of information according to said at lest two access standards utilizes one for these common

interface towards a mobile network (PLMN), to which the base station system is connected.

9. Mobile base station system as claimed in any of the previous patent claims, at which the central unit includes a software based radio transmitter/radio receiver (software radio).

10. Mobile base station system as claimed in any of the previous patent claims, at which allocation of bandwidth for the different access standards is made via a mobile network to which the system is connected.

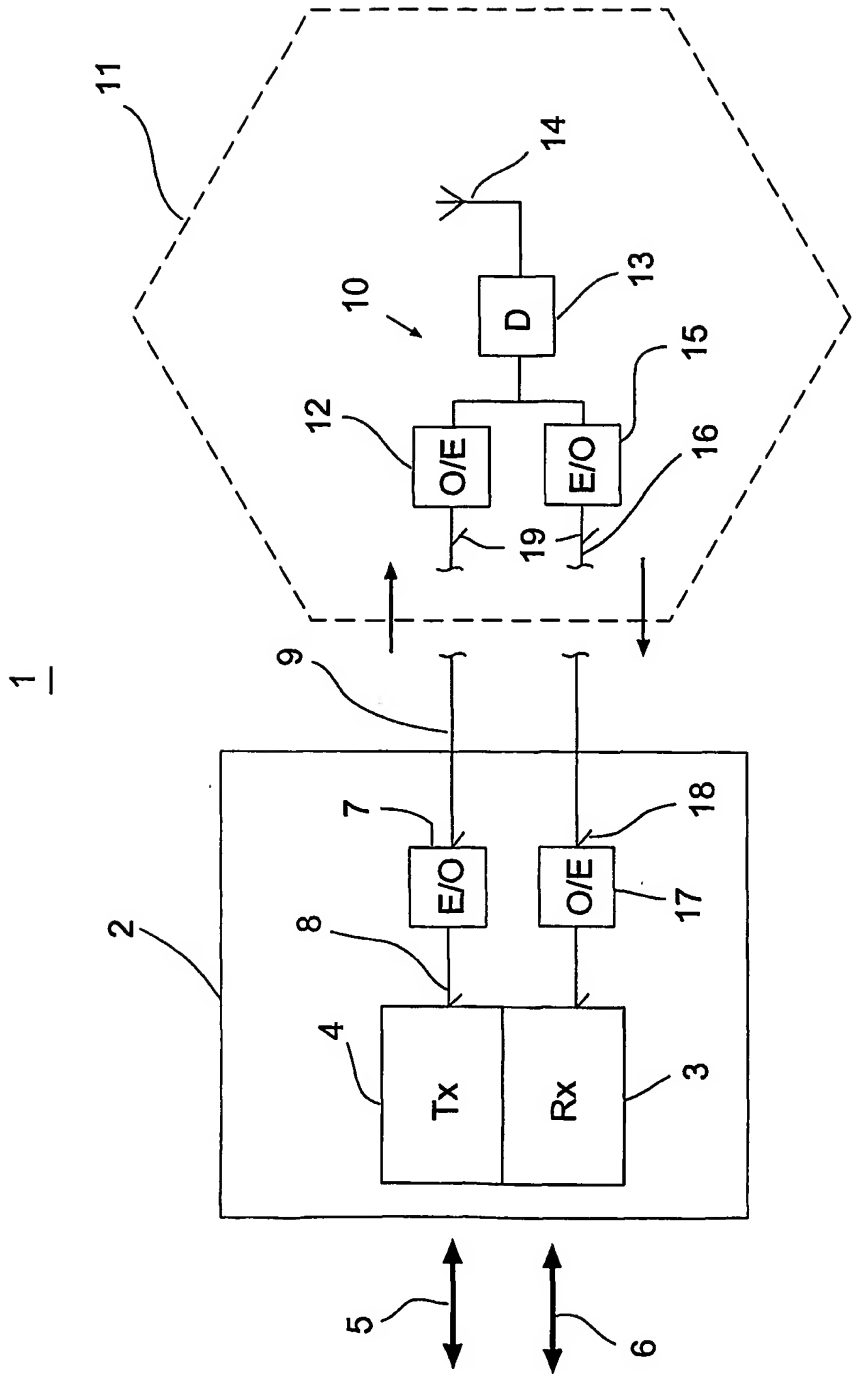


Figure 1

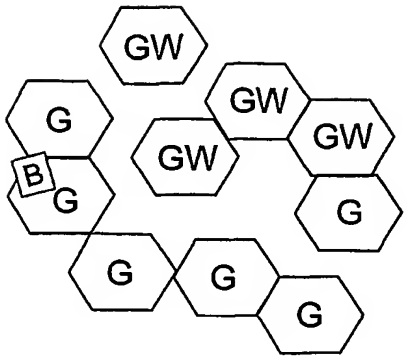


Figure 2a

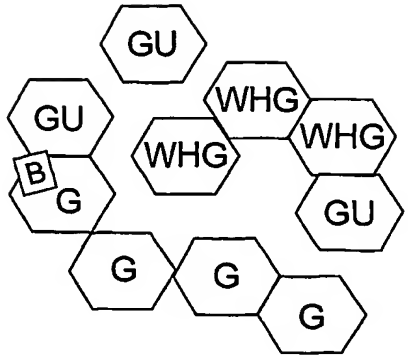


Figure 2b

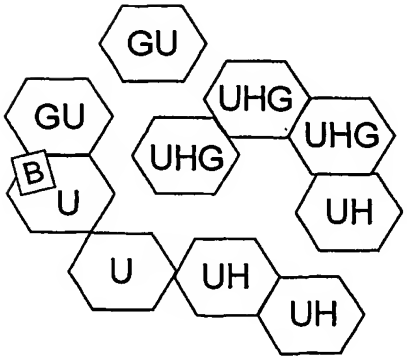


Figure 2c

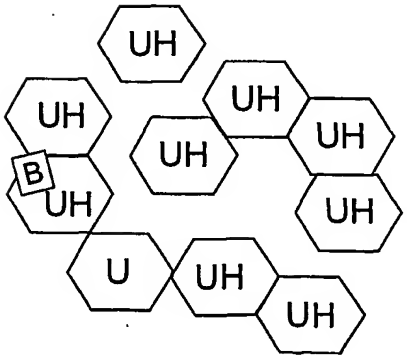


Figure 2d

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/02143

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	-Schuh, R.E. et al An architecteure for radio-independent wireless access networks Vehiclar Technology Conference, 1999 IEEE 49th On page(s):1227-1231 vol.2. 16-20 May 1999. 1999. abstract, figure 1,4,5. page 1230, column 1. paragraph IV. ---	1-10
Y	-Schuh, R.E. Hybrid fiber radio for second and third generation wireless systems Microwave Photonics, 1999. MWP `99. International Topical Meeting on On page(s):213-216 vol.1.17-19 Nov 1999. 1999. Figure 1. ---	1-10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 January 2002	24-01-2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Lars Ekeberg/js Telephone No. +46 8 782 25 00

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PCT/SE 01/02143

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5809395 A (HAMILTON-PIERCY ET AL), 15 Sept 1998 (15.09.98), column 42, line 7 - column 43, line 37, figure 1	1-10
A	US 5648961 A (EBIHARA), 15 July 1997 (15.07.97), column 1, line 35 - line 52	1-10
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 01/02143

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